

Appln. No. 10/014,848  
Amendment dated: October 14, 2003  
Reply to Office Action of 7/14/03

### REMARKS/ARGUMENTS

Claims 1-65 were pending in this application. Claims 1-37 and 62-65 are withdrawn. By way of this amendment, claims 46-54 have been cancelled without prejudice. New claims 66-68 have been added. Claims 38-45, 55-61 and 66-68 are pending for examination.

Claims 38, 44, 55 and 60 have been amended. Specifically, claim 38 has been amended to recite, in part, a matrix comprising between about 3% to about 15%, by weight, of a metal oxide uniformly dispersed within the matrix. These amendments are supported through out the specification, for example, at page 4, lines 7-10, as well as the claims as originally filed. Claims 44 and 60 have been amended to recite a gaseous stream/discharge having moisture that does not condense on the matrix. This amendment is supported by the specification at page 6, lines 18-19. Claim 55 was amended to recite, in part, a metal oxide matrix uniformly dispersed within the matrix, the matrix having a hydrogen sulfide breakthrough capacity greater than about 0.3 gH<sub>2</sub>S/ccC. This amendment is supported throughout the specification and claims as originally filed. New dependent claims 66-68 are directed to methods wherein sorbing hydrogen sulfide comprises oxidizing hydrogen sulfide to sulfur, and sorbing the sulfur on the matrix. These amendments are supported in the specification, for example, at page 6, lines 21-28. No new matter has been added.

### Rejection under 35 U.S.C. 102(b)/103(a)

Claims 38-41 and 46-50 were rejected under 35 U.S.C. 102(b) or, in the alternative, under 35 U.S.C 103(a) over JP 7-313,867 A (JP 867). These rejections are respectfully traversed.

JP 867 fails to disclose, teach, or suggest a method for removing an odorous compound from a gaseous stream, comprising, in part, forming an activated carbon-metal oxide matrix, wherein the matrix comprises between about 3% and about 15%, by weight, of a metal oxide uniformly dispersed within the matrix, and has a hydrogen

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sulfide breakthrough capacity greater than about 0.3 gH<sub>2</sub>S/ccC as recited in amended claim 38.

JP 867 discloses a method for deodorizing odors by passing air over a honeycomb formed from a mixture of activated carbon, a metal oxide, an organic acid, methyl cellulose, and a clayey substance. (JP 867 Translation, paragraphs 0001 and 0007.) In JP 867, activated carbon, a metal oxide, methyl cellulose, and a clayey substance are mixed, kneaded and extruded into a honeycomb. (JP 867 Translation, paragraph 0009.) JP 867 does not disclose an activated carbon-metal oxide matrix, wherein the metal oxide is uniformly dispersed within the matrix. In contrast to JP 867, the activated carbon-metal oxide matrix of the present invention is formed by mixing a ground carbon and metal oxide to form a mixture, extruding the mixture to form an extrudate, carbonizing the extrudate to form a carbonaceous mixture, and activating the carbonaceous mixture to form the matrix wherein the metal oxide is uniformly dispersed within matrix. (Present application, page 4, lines 3-10.) The structure of the activated carbon-metal oxide matrix of the present invention is advantageous because the highly dispersed metal oxide does not occupy the pores of the activated carbon. (Present application, page, 6, lines 4-9.) As such, the matrix of the present invention has a greater pore volume to adsorb odorous compounds, and therefore can adsorb greater quantities of these compounds (resulting in a high hydrogen sulfide breakthrough capacity of greater than about 0.3 gH<sub>2</sub>S/ccC).

Moreover, Applicants disagrees with the Examiner's assertion that it is prima facie obvious that activated carbon containing the same metal oxide will have the same hydrogen sulfide breakthrough capacity. Many factors contribute to the absorption capacity of deodorizing materials, including the microporosity of the carbon. As noted in JP 867, "physical absorption of malodorous molecules in the micropores of the carbon is the dominant factor in the deodorizing operation of active carbon." (JP 867 paragraph 0003.) JP 867 discloses a mixture of activated carbon, metal oxide, organic acid, methyl cellulose, and a clayey substance formed into a honeycomb for sorption, but does not disclose an activated-carbon metal oxide matrix. There is no teaching or suggestion in JP 867 to form the carbon-metal oxide mixture, and extrude, carbonize and activate it to form a matrix. The structure of the matrix provides a hydrogen sulfide breakthrough

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capacity greater than about 0.3 gH<sub>2</sub>S/ccC, as recited in independent claim 38. As noted above, the matrix of the present invention is advantageous because the highly dispersed metal oxide does not occupy (and reduce) the overall pore volume of the activated carbon. (Present application, page, 6, lines 4-9.)

As such, claim 38 is novel and patentable over JP 867. Claims 39-41 depend directly or indirectly from claim 38, and are patentable for at least the above-mentioned reasons. Claims 46-50 have been cancelled without prejudice. Withdrawal of these rejections is, therefore, respectfully requested.

Rejections under 35 U.S.C. 103(a)

Claims 38-41, 44-50, 53 and 54 were rejected under 35 U.S.C. 103(a) over JP 867. This rejection is respectfully traversed.

As noted above, amended claim 38 is patentable over JP 867. Claims 39-41 and 44-45 depend directly or indirectly from claim 38 and are patentable for at least the above-mentioned reasons. Claims 46-50, 53, and 54 have been cancelled without prejudice.

Applicants disagree with the Examiner's assertion that one skilled in the art would have expected that the process of JP 867 would have successfully removed hydrogen sulfide out of a gas with any humidity content. JP 867 is silent as to relative humidity. As noted above, one skilled in the art would not have been motivated to remove an odorous compound from a gaseous stream by forming an activated carbon-metal oxide matrix, wherein the matrix comprises between about 3% and about 15%, by weight, of a metal oxide uniformly dispersed within the matrix, and has a hydrogen sulfide breakthrough capacity greater than about 0.3 gH<sub>2</sub>S/ccC, and wherein the gaseous stream has a moisture content of about 60% to about 95% as recited in amended claim 45. For this reason, and the reasons mentioned above, dependent claims 44-45, and 53-54 are also patentable over JP 867. As such, withdrawal of this rejection is respectfully requested.

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Claims 38-54 were rejected under 35 U.S.C. 103(a) over JP 867 as applied to claims 38-41, 44-50, 53 and 54, and further in view of JP 9-192,485 A (JP 485). This rejection is respectfully traversed.

One skilled in the art would not have been motivated to combine JP 867 and JP 485 in the manner suggested by the Examiner to arrive at the present invention. As noted above, JP 867 fails to disclose, teach, or suggest a method for removing an odorous compound from a gaseous stream, comprising, in part, forming an activated carbon-metal oxide matrix, wherein the matrix comprises between about 3% and about 15%, by weight, of a metal oxide uniformly dispersed within the matrix, and has a hydrogen sulfide breakthrough capacity greater than about 0.3 gH<sub>2</sub>S/ccC as recited in amended claim 38. JP 485 discloses the use of an activated carbon carrying a metal oxide, such as magnesium oxide, for deodorizing air, wherein the activated carbon is activated in a specific environment. JP 485, however, also fails to teach or suggest extruding, carbonizing, and activating a carbon-metal oxide mixture to form the matrix of the present invention having the breakthrough capacity of greater than 0.3gH<sub>2</sub>S/ccC. As such, claims 38-45 are patentable over these references, either alone or in the proposed combination. Claims 46-54 were cancelled without prejudice. Withdrawal of this rejection is, therefore, respectfully requested.

Claims 55, 56 and 58-61 were rejected under 35 U.S.C. 103(a) over JP 867 in view of JP 485. This rejection is respectfully traversed.

One skilled in the art would not have been motivated to combine JP 867 and JP 845 in the manner suggested by the Examiner to arrive at the invention as recited in amended claim 55. As noted above, JP 867 discloses an activated carbon metal oxide mixture, but fails to disclose, teach, or suggest, a method for reducing the concentration of a sulfide present in a gaseous discharge from a waste water treatment system, as claimed, including providing a gaseous discharge including at least one volatile organic compound and hydrogen sulfide, and contacting a gaseous discharge having a moisture content with an activated carbon-metal oxide matrix, wherein the matrix comprises between about 3% and about 15%, by weight, of a metal oxide uniformly dispersed

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within the carbon matrix, and has a hydrogen sulfide breakthrough capacity greater than about 0.3 gH<sub>2</sub>S/ccC. JP 867 is silent as to the inclusion of volatile organic compounds in the air, as well as the relative humidity of the air. JP 845 fails to cure the deficiencies of JP 867. As noted above, this reference discloses the use of an activated carbon carrying a metal oxide wherein the activated carbon is activated in a specific environment. The proposed combination would not have resulted in an activated carbon-metal oxide matrix, wherein the metal oxide is uniformly dispersed within the matrix. As such, claim 55 is patentable over the cited references, either alone or in combination. Claims 56 and 58-61 depend directly or indirectly from claim 55, and are patentable for at least the above-mentioned reasons. Withdrawal of this rejection is, therefore, respectfully requested.

Claims 55-61 were rejected under 35 U.S.C. 103(a) over JP 867, in view of JP 485 in further view of EP 0 643 014 A1 (EP 014). This rejection is respectfully traversed.

One skilled in the art would not have been motivated to combine JP 867, JP 485, and EP 014 in the manner suggested by the Examiner to arrive at the invention as recited in claim 55. As noted above, the JP 867 and JP 845 references each fail to teach or suggest the present invention as claimed in claim 55. The EP 014 reference also fails to teach or suggest the present invention.

EP 014 discloses the use of a metal oxide carrying activated carbon for decomposing methylmercaptan and trimethylamine. However, EP 014 fails to disclose air also including hydrogen sulfide. In fact, one skilled in the art would have recognized that sorption of methylmercaptan and trimethylamine would reduce the hydrogen sulfide sorption capacity of the mixture in JP 867. As such, one skilled in the art would not have been motivated to combine the volatile organics of EP 014 with the hydrogen sulfide containing air of JP 867 to arrive at the invention as recited in claim 55.

Moreover, even if the references were combined in the manner suggested by the Examiner, the proposed combination would not have resulted in the invention as recited in claim 55. The combination of JP 867, JP 845 and EP 014 would have resulted in an activated carbon-magnesium oxide mixture formed into a honeycomb used to deodorize

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air comprising methylmercaptan and trimethylamine, ammonia and hydrogen sulfide, wherein adsorption of methylmercaptan and trimethylamine would compete with the sorption of hydrogen sulfide. The proposed combination would not have resulted in a method of contacting a gaseous discharge including at least one volatile organic compound and hydrogen sulfide with an activated carbon-metal oxide matrix, wherein the metal oxide is uniformly dispersed within the matrix, and it has a breakthrough capacity greater than about 0.3 gH<sub>2</sub>S/ccC, and producing a product stream having a sulfide concentration of less than about 0.1 ppm. As such, claim 55 is patentable over the cited references, either alone or in combination. Claims 56-61 depend directly or indirectly from claim 55 and are patentable for at least the above-mentioned reasons. Withdrawal of this rejection is, therefore, respectfully requested.

New claims 66 and 67-68 depend from independent claims 38 and 55 respectively, and are patentable over the cited references for at least the above-mentioned reasons. Moreover, unlike the cited references, the matrix of the present invention oxidizes hydrogen sulfide predominantly into elemental sulfur instead of sulfuric acid. (Present application, page 6, lines 21-28.) The space occupied by one molecule of sulfuric acid would accommodate up to 3.5 molecules of sulfur. As such, because sulfur molecules are smaller than sulfuric acid molecules, the matrix of the present invention is able to remove more hydrogen sulfide because it is able to adsorb more of its oxidation product, elemental sulfur. These claims are, therefore, patentable over the cited references.

### CONCLUSION

In view of the foregoing Amendments and Remarks, this application is in condition for allowance. A notice to this effect is respectfully requested. If the Examiner believes that the application is not in condition for allowance, the Examiner is requested to call Applicants' attorney at the telephone number listed below.

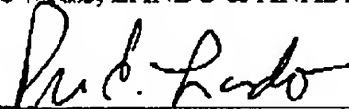
If this response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicants hereby request any necessary extension of time. If

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there is a fee occasioned by this response, including an extension fee that is not covered  
by an enclosed check please charge any deficiency to Deposit Account No. 500214.

Respectfully submitted,

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